

Reducing Nonpoint Pollution with Public Outreach / Education Programs

Larry S. Coffman, Associate Director
Department of Environmental Resources
Prince George's County Maryland, June 2001

Abstract

It has long been assumed that outreach programs directed at changing the behavior of residential property owners can have an impact on reducing nonpoint pollution associated with such activities as lawn / garden care, car care, disposal of yard wastes / household chemicals. From 1992 through 1997 Prince George's County, Maryland's Department of Environmental Resources (PGDER) conducted a comprehensive public education program to test this assumption. PGDER 's program attempted to measure the effectiveness of outreach efforts in three ways; 1) through before and after program surveys, 2) by using a water quality modeling assessment tool and, 3) by monitoring the water quality of the receiving waters before and after the outreach program. The findings indicate that the effectiveness of an outreach program depends greatly on; 1) the level of funding available to sustain efforts on a long-term basis; 2) the types of outreach venues used; and, 3) tailoring outreach programs to address unique issues and socioeconomic factors in the target community.

It was found that even with the intensive educational effort of this program, lasting over one year, the degree of change was marginal. It was found that the cost of a multifaceted targeted education program was far greater than anticipated and cost prohibited to implement in the same manner on a countywide basis. Quantifying and understanding the fate and transport of urban pollutants and the effectiveness of the outreach efforts proved to be both complex and difficult.

I. Background

In 1992 PGDER received a 319 grant from the State of Maryland's Department of the Environment to conduct a comprehensive public outreach program in a small residential community named Kettering. Kettering is a middle income white collar medium density (1/4 acre lots) residential community with 1,125 units covering about 380 acres. It was developed in the early 1970's with no stormwater quantity or quality controls. The total population of the community is approximately 2800

residents. Baseline water quality data indicated degradation of the receiving stream's water quality from nonpoint sources (i.e. elevated levels of nitrogen, phosphorus and heavy metals).

II. Outreach Approach and Philosophy

This outreach / education program was designed as a learning tool and to be the cornerstone for County in the development of future outreach programs for residential communities. One fulltime project manager was assigned to program to effectively coordinate all aspects of the program's planning and implementation. Since we wanted to learn as much as we could about developing effective outreach efforts, the program was designed to be a very comprehensive covering many topics and using numerous educational methods and tools.

The intent was to localize the program encouraging residents to take ownership and understand that improving the waters of Kettering was also linked to improving the quality of life in their community. The benefits and impacts that we highlighted were a cleaner healthier neighborhood with less harmful chemicals, aesthetic improvements that may increase property values and saving time and money.

Twelve educational topics were chosen. For each topic, the residents were shown how they could directly benefit by changing their behavior. Our approach was to spend an entire month on each topic so as not to overwhelm the residents with too much information on a variety of topics all at once. To insure that the most residents possible heard the message a variety of outreach tools were used. Each month every home received a mailing that included a cover letter and all enclosures important for the month's topic. In addition, an article was printed each month in the local newsletter, "The Olde Mill News". The article covered the issue of the month and updated the residents on significant milestones. The newsletter has a circulation of about 1200 throughout Kettering. Displays, flyers, and workshops were also used when needed for specific issues and topics.

A colorful distinctive letterhead was designed specifically for this project so that the mailings would immediately be recognized. We found out later from the community that our letterhead was indeed a big attention getter.

Another goal of the participation efforts was to include a large number of community participants, through a variety of means to help with education efforts. This included setting up an Environmental Advisory Committee composed of community activists and leaders, working with scout troops in a variety of environmental activities such as adopting the stream and wetlands and involving the local school students in an environmental enhancement projects (tree planting and stream monitoring) on their school grounds.

Establishing the advisory committee helped convince the residents that this was their project more than a County, State, or Federal project. It was believed that if the community viewed the County efforts as an imposition from above, it might foster a sense of apathy and complacency, or worse, a sense of resentment. Creating a feeling that the success or failure of the project relied heavily on the community would help the residents see the importance of local action. The residents knew that the more they helped with the project, the more benefits the community could receive.

III. Community Activity and Issue Assessments and Characterization

Before the public outreach program could be developed, it was necessary to identify and understand unique issues and problems in the Kettering community. Several key reconnaissance activities were conducted to characterize the community. These activities are described below.

1. Televising Storm Drains - Prior to initiation of the program the entire storm drain system was televised to look for illegal discharges, connections and problems. Several illegal connections and discharges were discovered. Two were from a small commercial development in the watershed and were discharges associated with restaurants. Floor drains were connected to the storm drainage system. These drains were routinely used to dispose of food wastes, grease and cleaning chemicals. One illegal connection was from a large backyard kennel operation. Animal wastes, trash and debris had been flushed into the storm drain system on a daily basis for about 20 years. The storm drain serving this kennel was partially blocked from these wastes. In an area of the subdivision under constitution, it was noted that the storm drain was partially filled with sediment due to poor maintenance of sediment control devices. Appropriate enforcement actions were taken to correct these activities.

Also noted occasionally throughout the systems were piles of debris, yard waste and trash resulting from illegal dumping. We also found a number of poorly constructed field connections where sediment was washing into the pipe system.

2. Community Windshield Tour - It was important that the staff working on the project get to know the community on an intimate basis. Several teams drove and walked through the entire community to identify unique problems and typical homeowner activities that should be targeted. This included also understanding social and economic issues or barriers (language, income, education, cultural, community standards, etc.). Other activities were noted such as level of property maintenance, importance of landscaping, car care, erosion problems, drainage problems, use of professional lawn services, number of abandoned cars, etc. All of the information gathered was used to craft the initial survey and to design the educational program.

3. Community Institutions - All community institutions and groups that could play a role (problem identification or program participation) were identified and contacted about the project. These included schools, churches, libraries, sport clubs, and community organizations. In every case we found all of the institutions to be extremely cooperative and helpful volunteering their services, facilities and even money to help in the outreach efforts.

4. Pre-Outreach Program Survey - The initial public survey questions were based on the community characterization work described above. The survey was given to all 1,125 single-family property owners in Kettering project area. The purposes of the survey included: 1) to measure the level of environmental awareness of the community residents; 2) to determine the extent at which community residents engaged in daily activities affecting non-point source pollution; 3) to determine how the community perceived the project; and, 4) helped identify the target audience, 5) identify special issues and key motivators. The survey questions and results of the first and second survey questions are shown in the attachments.

5. Pre-Outreach Program Results - Out of 1,125 households mailed a survey, 403 or thirty six percent (36%) responses were returned. This response rate was quite high compared to other public

survey efforts by PGDER. This high response rate was due in part to the extensive preprogram publicity and outreach efforts by the PGDER staff, elected officials and other partners in the program. Due to the large response rate, it was assumed that the results were representative of the community as a whole. However, it must be noted that 64% of the households did not respond which could suggest that most of the community was unmotivated to participate in this effort. A few of the findings are discussed below.

A. General Knowledge and Participation - The initial public survey results revealed that Kettering residents lacked a general knowledge and awareness of basic nonpoint source water quality issues. Fifty-eight percent (58%) of the residents did not know stormwater runoff from residential neighborhoods causes water pollution problems. An alarming seventy-two percent (72%) of the Kettering residents did not know how to report illegal dumping or other pollution problems to local officials. The participation levels in various widely publicized County environmental programs were also low. Although seventy-two percent (72%) of the residents were aware of the county's household hazardous waste collection program, only thirty-eight percent (38%) of the residents used it.

B. Automobile Care – The initial survey responses on residential automobile care provided considerable insight into the pollution potential of this type of activity. Approximately thirty-one percent (31%) of the residents change their own car oil. The survey showed that an overwhelming ninety percent (90%) of the residents who change their own oil recycle it. However, ten percent (10%) of the used oil is still being disposed of improperly. Similarly, twenty-five percent (25%) of the residents change their own antifreeze.

C. Lawn Care – Survey results showed that approximately eighty-seven percent (87%) of all of the residents apply fertilizers to their lawn, and eighty percent (80%) use pesticides. In spite of these efforts approximately forty-nine percent (49%) were still not satisfied with the appearance of their lawn.

The majority of fertilizer applications occur in the spring and fall although some apparently apply it all year long. Applying fertilizers in the spring can increase irrigation needs, mowing requirements, and may weaken grass roots. The Maryland Cooperative Extension Service had developed an environmentally sensitive, low cost lawn care program, which recommended restricting fertilizer

applications to the fall. Only eleven percent (11%) of the Kettering homeowners followed this fertilizer application program. The Extension Services' program was adopted as the recommended program for this educational component on lawn care.

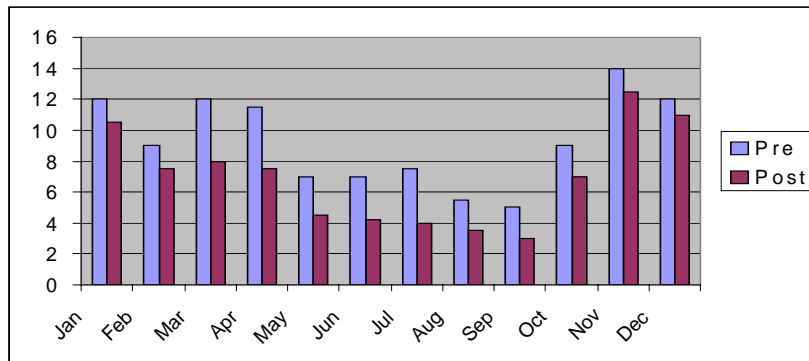
6. Water Quality Modeling

Predictions as to effectiveness of the educational program were developed using the HSPF continuous simulation water quality model (EPA, 1983). The modeling effort was focused on nutrient reductions in residential areas based on anticipated benefits from the recommended lawn care educational programs. Due to seasonal application interests and the importance of storm size and hydrology on nutrient washoff, a continuous simulation model was selected to provide insight on the potential benefits of the public education program. Specific benefits evaluated with the model include reductions in application rates and shifting application periods from spring to fall..

The data generated from the model was used to make informed decisions regarding how water quality improvement programs should be tailored for this particular community to be most effective. The detailed description of the modeling work is not described in this paper. It is outlined in an unpublished paper by Jennifer Smith titled "Public Survey and Pollutant Model for Prince George's County, 1994". An example of the types of HSPF modeling outputs is shown below in Figure 1.

The modeling efforts assumed a 70% participation rate in the recommended lawn care program. The results indicate that one could expect to see an annual loading reduction of 19% in nitrogen and a 76% for phosphorus and about a 40% reduction in nitrogen in the spring time months. One important finding with the modeling was that we could see the effects of shifting fertilizer application activities from spring to fall. By shifting fertilizer application rates to the fall, reductions in pollutants during critical spawning times could be seen. Seasonal reductions in nitrogen and phosphorus and other pollutants alone could yield significant ecological benefits.

Figure 1 Mean Monthly Nitrogen Concentration



(Est. from HSPF for 8-year simulation)

IV. Development and Implementation of the Education Programs

Based on the survey results and the community characterization work the final educational programs were developed on the themes shown below.

1. Household Hazardous Wastes
2. Recycling
3. Lawn Care – (Testing, Fertilizer, Pesticides, Herbicides and Erosion)
4. Car Care (washing, oil, antifreeze, chemicals)
5. Spills and Dumping (reporting and prevention)
6. Swimming Pool Discharges
7. Yard Wastes Disposal and Composting
8. Back Yard Habitat Creation
9. Animal Wastes
10. Landscaping for Water Quality
11. Volunteer Stream Monitoring (biological)
12. Community Clean Up Programs

These educational topics were presented to the community over the course of a year using a wide variety of outreach methods. The methods included workshops, community meetings, community

day displays, flyers, community newsletters, direct mail and brochures. Some educational topics (lawn care, car care, landscaping, composting, recycling and volunteer monitoring) received the full complement of educational techniques others topics used only some of the outreach techniques. The education program took place from June of 1992 through June of 1993 covering one of the education topics each month. There was no follow-up educational program thereafter.

V. Post Program Survey Results

Three month after the completion of the one year educational program the second post program survey was mailed to the same 1,125 households. The questions were essentially the same. One thing noted was 5% of residents had moved during the 16 month period between surveys (based on the number of returned unopened surveys due to incorrect names). The return rate was only 15% as compared to the first survey of rate of 36%. Further, we did not check to see if those responding to the first survey were the same as the second survey. Different groups responding to the first and second surveys could account for some of the anomalies in the survey findings.

The survey indicated that 94% of the respondents would adopt the pollution reduction programs proposed by the County. However, this overwhelming support or willingness to adopt the environmentally friendly programs was not supported by the comparison of the two survey results. For example, the educational lawn care program recommended that lawns only be fertilized in the fall and using 1/3 the recommended rate. The responses in the two surveys show essentially no change in the seasonal application of fertilizer with equal applications in spring and fall. The lawn care program recommended a reduction in the use herbicides and pesticides. The second survey showed no change in the use of herbicides and increase in the use of pesticides.

There were some changes in the survey that were very positive such as an increase in the number of people that believe urban stormwater does cause problems. There was an increase in the number of people that recycle oil and know how to report illegal pollution problems.

The survey findings did not correlate well with the modeling results and given the anomalies in the comparison of the two no further modeling was attempted using the pre and post program survey

findings. It was decided to wait for the water quality monitoring results before additional modeling was conducted.

VI. Water Quality Monitoring

The program involved a long term monitoring component. Receiving water quality data was collected during pre program conditions in 1992 -1993 and post program conditions in 1996 – 1997, three years after the conclusion of the outreach program. The delay in the monitoring was to allow for the completion of other watershed restoration projects such as wetland construction and reforestation to be completed and stabilized. These structural components were down stream from the outfall of the residential community where the public outreach efforts were focused. The pollutants monitored included Pb, Zn, NH₃, BOD, NO₃ / NO₂, TP, TKN and TSS. ISCO automated samplers were used and the event mean concentrations were calculated. The chart below shows the findings of the water quality data. Many of the post program pollutants increased.

It is interesting to note that the median NO₃/NO₂ level dropped by 42% (also predicted in the model) and the median TP level dropped 31% (highlighted in Figure 2). This drop is most likely the results of the education program to reduce the use of the fertilizer but this is not confirmed by the survey result that indicates little change in the timing or use fertilizer applications.

Figure 2. Comparison of Pre / Post Program Water Quality EMC's

Pollutant	Pre Program			Post Program		
	Min	Max	Median	Min	Max	Median
Lead	6	26.1	11	3.8	107.7	10.7
Zinc	30.1	377	60	25.2	357.7	41.4
NH ₃	ND	1.1	ND	0.06	0.51	0.12
BOD	3.7	32.7	5.5	2.46	34.09	10.44
NO ₃ /No ₂	0.22	0.89	0.45	0.09	0.47	0.26
TP	0.2	0.87	0.45	0.07	1.01	0.31
TKN	ND	4.8	1.6	0.56	3.43	1.16
TSS	15.4	115.5	45	28	346	93

VII. Outreach Costs

The Figure 3 below summarizes the outreach program costs. It was clear as the outreach program was being planned that the development and implementation of a comprehensive and aggressive education program would be extremely labor intensive. Planning, development and coordination of the various program components took the full time effort of a dedicated person to manage. This work was supplement by many individuals that assisted in carrying out each program element. For example, the reconnaissance study required four people working for two weeks to fully complete and develop recommendations. The six workshops conducted required the expertise of other staff and local professionals to develop and implement. The total program cost worked out to be about \$84,000. This covered staff time for all phases of the program planning and implementation.

Figure 2. Summary of Outreach Program Costs

Program Planning (staff)	\$ 2,100.00
Reconnaissance (staff)	\$ 6,512.00
Televise Stormdrains (contract)	\$ 10,000.00
Project management (staff)	\$ 45,619.00
Workshops (staff & materials)	\$ 4,644.00
Publications (direct)	\$ 4,852.00
Mailing (direct)	\$ 7,818.00
Other Support (staff)	\$ 2,150.00
Total	\$ 83,695.00

From these direct costs, one can estimate the cost of conducting a similar comprehensive education program on a countywide basis. The cost of this program per residential unit (1,125) is about \$75. The County has about 250,000 single-family units. Based on the Kettering costs a program of same nature and level of intensity would cost approximately \$18,750,000. Obviously, this would be cost prohibited.

However, we did note in the initial survey results that most people followed fertilizers applications rates on the product label. Based on this, it would seem that a much more cost effective way to reduce the use of fertilizers would be to encourage manufactures to change their recommendations to use 1/3

less and only fertilize in the fall. Of course, this is not likely, as it would have significant impacts on sales and profits.

VIII. Conclusions

The Kettering project allowed PGDER to develop a better understanding of the complexities, costs and level of work required to develop outreach programs for nonpoint pollution associated with residential communities. Outreach is not easy and more costly and labor intensive than ever imagined. Although the survey results indicate an overwhelming willingness by the property owners to adopt more environmentally sensitive activities, the survey results did not demonstrate a significant change in targeted activities as a result of this program's outreach efforts. However, the water quality monitoring data did indicate that the median EMC of nitrogen and phosphorus was less following the completion of the outreach program. However, it is not entirely clear that this reduction was directly related to the outreach efforts or could have been associated with variations in rainfall / runoff patterns and intensities.

The study lead us to believe that that outreach efforts target at manufactures of lawn care, car care products and lawn care service providers may potentially be more cost effective in reducing nonpoint pollution than direct outreach programs focused on the end users. One of the survey findings showed that most people got their information on the use of chemicals from product labels. If this is the major source of information for homeowners, it would make sense to work with manufactures to provide labels that include an environmentally friendly option (i.e., use less and only once / year in the fall).

It was also clear that the approach taken in this program was not as effective as anticipated. For a direct educational program to be effective, we now believe that it must be intense and sustained. The survey found that property ownership turnover was about 5% per year. Therefore, in just a few years a majority of the property owners will be new and uneducated. The recycling experience has shown that effective successful public education must be multifaceted with a long-term commitment.

The direct mail survey did not seem to be an effective way to measure changes in behavior. Perhaps, it was PGDER's lack of experience in developing effective surveys that was at fault. The survey information may have been a more effective tool if it had been done using door to door interviews. The

survey did however give us tremendous insight into the use of fertilizers, values of the community, level of knowledge, environmental interests, motivational factors and the magnitude of the problems associated with nonpoint pollution in an urban setting.

We felt the community characterization work was extremely helpful in the development of effective outreach materials targeted to unique problems in the community. Subsequent to the Kettering study we did conduct another residential outreach program in Seat Pleasant which is a blue-collar community. We found the problems in this community to be totally different. In Seat Pleasant, few if any homeowners fertilize their yards but, almost everyone repairs and maintains their own cars. Needless to say illegal dumping of oil, antifreeze and gasoline were the major problems. Many of the inlets in the neighborhoods were routinely used to dispose of oil.

The impact the Kettering project on our current outreach efforts was immense. What developed from the Kettering program was our "Streams Teams" program. One of the more successful parts of the Kettering project was the terrific cooperation and interest expressed by community groups and institutions. The Stream Teams program is a voluntary stream monitoring / adoption program that also incorporates all of the educational programs developed in the Kettering project. Stream Teams focuses on educating community groups, schools, scouts, homeowner associations and community watershed / environmental organizations.

Another consequence of the Kettering project was that it caused us to rethink our overall approach and philosophy towards controlling urban stormwater. Since this project only resulted in marginal changes in behavior, this encouraged us to begin to look at other options to outreach. It was noted during the project that if residential yards had a greater capacity to assimilate nutrients and generated less runoff, it might not be necessary to change homeowner's behavior at all. If residential communities were designed with disconnected impervious surfaces, use open drainage systems, use multifunctional landscaping, use rain gardens / bioretention, use more infiltration, and use amended soils (deep tillage and adding organic materials), these techniques would increase the ability of the urban landscape to capture, assimilate and cycle more pollutants. This project provided the impetus to further explore the development of the PRDER's Low Impact Design Technology to modify a subdivision's

design in ways to significantly reduce runoff and nonpoint pollution by creating a more ecologically functional landscape.

Attachments:

Kettering Public Survey Results

Activity	Second Survey	First Survey
	Percentage*	Percentage
Total Response Rate	15	36
Will Adopt Environmental Protection Programs	94	NA
Do Not Know SW Runoff Causes Pollution	40	58
Do Not Know How To Report Pollution Problems	55	72
Do Not Participate In County Recycling	2	13
Do Not Use Household Hazardous Waste Program	4	62
Do Not Recycle Used Oil	0	10
Do Not Recycle Antifreeze	15	NA
Change Own Antifreeze	24	25
Use Car Wash	37	29
Wash Car Weekly	19	24
Wash Car Monthly	33	39
Wash Car 2X/Year	26	23
Wash Car Yearly	6	4
Fertilize Own Lawn In Spring	46	43
Fertilize Own Lawn In Summer	9	10
Fertilize Own Lawn In Fall	44	40
Fertilize Own Lawn In Winter	8	7
Use Herbicides	56	30
Use Insecticides	41	42
Use Fungicides	22	15

* Percentage is to number of respondents

** Percentage of those who change their own antifreeze

Survey Questions

Kettering Community Demonstration Project Survey Two

This survey is being conducted by the Prince George's County Department of Environmental Resources to evaluate the effectiveness of the environmental education program. Should you have any questions, please contact Stephen Paul, Public Education Coordinator, at 925-7168.

Please answer each question by circling the appropriate response.

1. Did you return the first survey that was mailed to you last summer? Yes No
2. Do you think that you will adopt our environmental protection programs? Yes Very Likely Likely No
3. Do you believe that neighborhoods like Kettering cause water pollution problems in nearby streams?
Yes No Do Not Know
4. How did you hear about our environmental education programs? Mail Newsletter Workshop Library
Neighbor Other, Please Specify:
5. Do you change your own car oil? Yes No
6. If yes, do you take the used oil to a gas station or recycling center? Yes No
7. Do you change your own antifreeze? Yes No
8. If yes, do you take the used antifreeze to a gas station or recycling center?

Yes No
9. How often do you wash your car yourself? Weekly Monthly Twice Per Year Once Per Year Never
10. When you wash your car, will you do any of the following? (Circle all appropriate answers.)

a. Use a biodegradable and non-toxic detergent b. Divert the wash water onto the lawn c. Use less detergent d. Use less water e. Take it to a commercial car wash f. None

11. Are you aware of the County's Household Hazardous Waste Collection program? Yes No

12. will you use the County's Household Hazardous Waste Collection program? yes No

13. Do you participate in the County's recycling program? Yes No Sometimes 14. Do you know how to report illegal dumping? Yes No

15. When making landscape improvements to your yard, will you consider water quality and wildlife habitat features in your plan? Yes No

16. Do you currently have or will you add any of these wildlife habitat features in your yard? (Circle all appropriate answers.) Bird House Bat House Wild Flower Meadows Bird Bath Brush Piles Hedge Rows Bird feeder Small Pond Mature Trees Berry Producing Shrubs

17. How would you rate the environmental education program? Excellent Good Fair Poor No Opinion

18. Do you have any other comments?



Eugene T. Lauer
Director

Kettering

Community Demonstration Project

Would you like to have great looking
landscaping that attracts wildlife with
less time,
less money, and
less harmful chemicals?

Come out to our Wild Acres workshop and
learn how!

Date: Monday, October 26, 1992

Time: 7:00pm

Place: The Kettering Community Center

Each person that attends will receive a free tree sapling!

For more information call Stephen Paul at 925-7168.

An interpreter for the hearing impaired can be made available upon request.



Parris N. Glendening
County Executive

**Working Together For A
Cleaner, Healthier Community**

County Council

Richard J. Castaldi
Chairman
Anne MacKinnon
Vice Chairman
Jo Ann T. Bell
Frank P. Casula
James C. Fletcher, Jr.
Stephen J. Del Guidice
Sue V. Mills
Hilda R. Pemberton
F. Kirwan Wineland

